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## VARIABLE GRIP STRUCTURE

5 Technical Field

The present invention relates to a grip structure having a grip portion consisting of an elastic member. Examples of those having such a grip include writing tools such as mechanical pencils, ball-point pens and whiteout (eraser) pens, 10 cutting tools such as snap-off blade knives, chisels and screw drivers, input pens for use in personal digital assistants (PDAs) and electronic notebooks, and bicycle handle bars.

Background Art

15 Attempts have been made in pursuit of better gripping performance of such grip structures as those mentioned above. One example of them is a research and development project involving contrivances regarding the hardness, surface state and shape of the grip portion.

20 However, since a grip portion of an elastic member is usually fixed to the shaft cylinder, there is a limit to the satisfaction of the gripping person on account of the size of the gripping hand and his or her personal preference.

In order to solve this problem, an inventive method was 25 suggested by which the grip is formed to match the shape of the user's fingers (see Reference 1: Japanese Patent Application Laid-Open 2001-001681, (Claim 1 and Figure 1)). However, as this would require an impression material and a

mold, it would be expensive and, moreover, not only the molding work is troublesome but also the writing tool, though good for its user, would result in an exclusive use for only him or her (the user).

5        Then, there was made an attempt fir partially expanding or contracting the grip portion by turning the shaft cylinder (see Reference 2: Japanese Patent Application Laid-Open 2000-313193 (Claim 1, Figure 1 and Figure 2)).

10       However, according to Reference 2 cited above, though the grip portion can be expanded or contracted in the radial direction, it still left room for further development. Thus, according to Reference 2, as the expansion or contraction takes place uniformly in the circumferential direction, specific fingers are caused to feel unpleasant. Thus, a writing tool  
15       is usually gripped with three fingers including the thumb, index finger and middle finger. If, however, the grip portion is expanded (contracted) and adjusted mainly on the basis of the thumb, the index finger and middle finger will feel unpleasant.

20       In addition to the above, there were a wide variety of requirements regarding the relative hardness (hardness or softness) of the grip portion and, as a user mainly concerned about the relative hardness tends to purchase a product of a relative hardness meeting his or her preference, this again  
25       would result in a writing tool for only an exclusive use by that particular person (user).

## Disclosure of the Invention

The present invention essentially permits an elastic member and a shaft body which fixes the elastic member to be rotatable relative to each other and provides means for keeping  
5 their relative rotating actions, and is intended to enable each of various users gripping the object to select a state in which he or she can sense the best feeling of gripping.

According to the invention, there is provided a variable grip structure characterized in that it has an elastic member  
10 and a shaft body fixing the elastic member, which are rotatable relative to each other, and means for keeping their relative rotating actions.

In the foregoing structure, the sectional shape of the elastic member can be made a deformed shape.

15 Also in the foregoing structure, slits or grooves can also be formed in the direction of the length of the external face of the elastic member.

Also in the foregoing structure, the hardness of the elastic member can also be made partially different.

20 Further, the surface roughness of the elastic member can also be made partially different and varied.

Also in the foregoing, it is also possible to provide a structure in which the elastic member is configured of a base material and a non-base material, the non-base material  
25 area is partially provided in the base material, and the hardness of the non-base material area is made greater than the hardness of the base material.

Further in the foregoing structure, it is also possible to provide a structure in which means of fixing the elastic member to the shaft body is provided such that at least one engaging portion is formed in either the internal face or the external face of each end of the elastic member, and an engagement receptacle portion which will be engaged with the engaging portion is formed on at least either one of a forward member positioned ahead of the grip portion and a rear member positioned behind the grip portion.

Also in the foregoing, the sectional shape of the engaging portion and engagement receptacle portion can be T-shaped.

Also in the foregoing, it is also possible to provide a structure in which the engaging portion and the engagement receptacle portion are respectively a hole and a stub engaging with the hole.

Also in the foregoing, it is also possible to provide a structure in which the engaging portion and the engagement receptacle portion are formed in a direction substantially parallel to the direction of the length of the shaft body.

Also in the foregoing, it is also possible to provide a structure in which the engaging portion and engagement receptacle portion are formed on at least either one of the forward end face and the rear end face of the grip.

Also in the foregoing, the engaging portion and engagement receptacle portion can also be formed in a direction perpendicular to the direction of the length of the shaft body.

Also in the foregoing, it is also possible to provide a structure in which a stopping portion is formed on the internal

face of the grip, and that stopping portion is held between a plurality of shaft cylinders.

Also in the foregoing, it is also possible to provide a structure in which the elastic member is held, in a state  
5 of being compressed in the lengthwise direction, between the forward member and rear member.

Also in the foregoing, it is also possible to provide a structure in which a ring-shaped member composed of an elastic material intervenes inside either one of the forward member  
10 and the rear member rotating relative to each other.

Also in the foregoing, it is also possible to provide a structure in which the forward member and the rear member rotating relative to each other are brought into contact and ribs which are engaged with and disengaged from each other  
15 are formed in the contacting portions.

Also in the foregoing, it is also possible to provide a structure in which the forward member and the rear member rotating relative to each other urge each other.

Also in the foregoing, ribs which are engaged with and  
20 disengaged from each other can also be formed on the internal faces or the external faces of the forward member and rear member rotating relative to each other.

Also in the foregoing, a restricting part can also be provided to restrict in the rotating directions of the forward  
25 member and rear member rotating relative to each other.

Further according to the invention, there is provided a variable grip structure for a writing tool, wherein the cylindrical body of the writing tool has a grip body composed

by coupling in series a substantially cylindrical elastic member between a forward shaft constituting the cylindrical body and a rear shaft,

the forward end of the elastic member is fixed to the rear end of the forward shaft,

the rear end of the elastic member is firmly adhered to the forward end of the rear shaft, and

a rotational mechanism is provided in the serially coupled grip body to enable the forward shaft and the rear shaft to rotate relative to each other and to be stopped in a prescribed rotational position.

In the variable grip structure according to the invention, a concave portion and a convex portion are formed in a twisted state in the grip portion deformed by rotation, and fingers can be positioned on the twisted concave portion. The angle of twist can be selectively adjusted by each individual user as he or she likes. As the grip portion is extended or contracted by the twisting operation, the hardness of the grip portion can be varied according to the angle of twist.

#### Brief Description of the Drawings

Figure 1 is an external view showing an example in which a variable grip structure according to the invention is used in a writing tool;

Figure 2 is an external view showing an action of the grip structure of Figure 1;

Figure 3 is a perspective view showing the essential part of Figure 2;

Figure 4 shows a longitudinal section of Figure 1;

Figure 5 shows a section of a variation of the method of fixing a grip portion to a forward shaft;

Figure 6 shows a section along line A-A in Figure 4;

5      Figure 7 shows a section along line B-B arrowed in Figure 4;

Figure 8 shows a longitudinal section of the essential part of a variation of means for keeping rotating actions;

10      Figure 9 shows a longitudinal section of the essential part of another variation of means for keeping rotating actions;

Figure 10 shows a section along line C-C arrowed in Figure 9;

15      Figure 11 shows a longitudinal section of still another variation of means for keeping rotating actions;

Figure 12 is an exploded perspective view showing the essential part of Figure 11;

Figure 13 is an external view showing of a variation of the grip portion;

20      Figure 14 shows a cross section of an example before the action shown in Figure 13;

Figure 15 is an external view showing another variation of the grip portion;

Figure 16 shows a section along line D-D in Figure 15;

25      Figure 17 is an external perspective view showing still another variation of the grip portion;

Figure 18 shows a longitudinal section of a variation of the means of fixing the grip portion to the shaft body;

Figure 19 shows a section along line E-E in Figure 18;  
Figure 20 shows a section along line F-F in Figure 18;  
Figure 21 is an exploded perspective view showing the  
essential part of Figure 18;

5        Figure 22 shows a longitudinal section of shows a  
longitudinal section of a variation of the means of fixing  
the grip portion to the shaft body;

Figure 23 shows a section along line G-G in Figure 22;  
Figure 24 is an exploded perspective view showing the  
10    essential part of Figure 22; and

Figure 25 is an exploded perspective view showing the  
essential part of the variation of the means of fixing the  
grip portion to the shaft body.

#### 15    Best Modes for Carrying Out the Invention

Modes for carrying out the invention will be illustrated,  
and will be described in detail with reference to the drawings.

A first embodiment of the invention will be described  
with reference to Figure 1 through Figure 4. Figure 1 is an  
20    external view showing a case that there is no rotation of an  
elastic member relative to a shaft body. Reference numeral  
1 denotes a grip portion made of a soft elastic member, and  
the grip portion 1 has a hollow portion 1c. The forward end  
side (the lower side in the drawing) of the grip portion 1  
25    is unrotatably fixed to a forward shaft (forward member) 2.  
On the other hand, the rear end side (the upper side in the  
drawing) of the grip portion 1 is also unrotatably fixed to  
a middle shaft (rear member) 3. Its rear shaft 4, though



unrotatably fixed to the forward shaft 2 via a linking member 7, is rotatably arranged relative to the middle shaft 3. Therefore, when the middle shaft 3 and rear shaft 4 are held with fingers or the like and rotated relative to each other, the forward shaft 2 rotate together the rear shaft 4 by way of the linking member 7 (Figure 4). This causes the grip portion 1 to be rotationally deformed in a twisted state (Figure 2). Incidentally, as the grip portion 1 is also rotationally deformed when the forward shaft 2 and the middle shaft 3 are held with fingers and rotated relative to each other, it is not absolutely necessary to link the forward shaft 2 and the rear shaft 4 with the linking member 7 as in the manipulation described above.

An embodiment of the invention will be described in detail with reference to Figure 4 and Figure 5. A plurality of grooves 1a are formed inside the grip portion 1 in the forward part, and engage with a plurality of stubs 2a formed in the rear part of the forward shaft 2. This causes one (forward) end of the grip portion 1 to be unrotatably fixed to the forward shaft 2. A plurality of grooves 1a are also formed in the rear part of the inside of the grip portion 1, and engaged with a plurality of stubs 2a formed outside the middle shaft 3, resulting in unrotatable fixation of the other (rear) end of the grip portion 1 to the middle shaft 3. The means of fixing the grip portion 1 to the forward shaft 2 and to the middle shaft 3 are not limited to grooves (or stubs) 1a formed at the two ends of the grip portion 1 and stubs (or grooves) 2a formed on (in) the forward shaft 2 and the middle shaft

3 to engage with the grooves 1a, but other suitable fixing means or method as an adhesive, thermal fusion, ultrasonic deposition, caulking or press-fitting may be used.

Also, various cases are applicable without being  
5 restricted to the pluralities of stubs and grooves. An example of such variation is shown in Figure 6 and will be described. A plurality of T-shaped grooves 1b are formed at the forward end of the inside the grip portion 1, and a plurality of T-shaped stubs 2b formed in the rear part of the forward shaft 2 engage  
10 with these T-shaped grooves 1b in an inserted state. Thus, the forward part of the grip portion 1 is unrotatably fixed to the forward shaft 2. The T-shape intends to mean and include a configuration in which a wider groove 1b1 (or stub 2b1 protruding from the forward shaft 2) is formed in a part distal  
15 to the shaft center in the cross section and a narrower groove 1b2 (or stub 2b1 protruding from the forward shaft 2) in a part proximal to the shaft center. By forming the means of engaging the grip portion 1 and the forward shaft 2 in a T-shape in this way, the deformation of the linking portion to the  
20 forward shaft 2 at an end face of the grip portion 1 with the relative rotation can be kept to the minimum possible, and the grip portion 1 is thereby prevented from coming off the forward shaft 2.

Though this embodiment is supposed to be a retractable  
25 writing tool having a ball-point pen 6 in a shaft body, a mechanical pencil, a solid correcting tool or the like may be disposed as well. Further, a gap 16 is formed between the middle shaft 3 and the linking member 7, and a ring 8 which

consists of a soft member and whose sectional shape is rectangular, circular or oval is formed in the gap 16 to provide a frictional resistance force against the relative rotation of the middle shaft 3 and the linking member 7. In other words, a frictional resistance force in the rotating direction is provided so that the restoring action of the grip portion 1 is prevented when the middle shaft 3 and the grip portion 1 are rotated relative to each other. Thus, the ring 8 obstructs the restoring action occurring when the grip is twisted. Further, the internal face in which the ring 8 is positioned from the rear end of the middle shaft 3 is in a conical shape, slightly expanding the part in which the ring 8 is positioned toward the rear end. By fitting the ring 8 to the linking portion 7 and then minimizing the frictional resistance occurring between the ring 8 and the internal face of the middle shaft 3 when the middle shaft 3 is fitted from front, the twist or the like of the ring 8 is prevented.

Further, though the retracting mechanism in this embodiment uses a so-called David cam mechanism (rotational cam mechanism) configured of a cam cylinder 9, a rotor 10, a slider 11, a knocking member 11a fixed to that slider 11, a cam spring 12, a forward spring 13 and so forth, the configuration is not limited to this, but a retracting mechanism may, for instance, use clip manipulation or be a screwing-out mechanism. Furthermore, the writing tool may as well have no retracting mechanism, and be fitted with a cap covering the writing part. Since this retracting mechanism is well known by a structure which makes the writing

tip retractable by knocking, for instance by knocking the rear end, it is supposed to be as illustrated (Figure 4) and its detailed description will be dispensed with.

A concave portion 1d is formed in the surface of the grip portion 1, and the concave portion 1d is coated with a rubber-like paint whose surface is relatively smooth, but this concave portion 1d may as well be molded as another member and partially embedded into the grip portion 1. In other alternative, the concave portion (non-base part) 1d and the other part (base) than the concave portion 1d may be molded integrally by such means as two-colored molding. In this configuration, the two parts may be the same in hardness but different in color, or differentiated in hardness, but where they are to be differentiated in hardness, it is preferable for the concave portion 1d to be greater in hardness. More specifically, it is preferable for the concave portion 1d, with which fingers are to come into contact, to be 50 to 70 in Shore hardness and for other parts to be 20 to 50 in Shore hardness.

Although typical materials for the grip portion 1 include silicone rubber, nitrile butadiene rubber, natural rubber, styrene rubber, styrene butadiene rubber, butadiene rubber, chloroprene rubber and urethane rubber, the choice is not limited to these, but the material can also be selected from various other alternatives.

Instead of the hardness, each may as well be differentiated in surface roughness from others. This differentiation may be achieved through coating as described or by such means as

two-colored molding. More specifically, it is preferable for the surface of the concave 1d, namely the part with which fingers are to come into contact, to be shaped relatively rough and those of other parts to be relatively smooth. The anti-slip effect would be enhanced and an improved feeling of grip can be expected.

Further, as shown in Figure 7, arciform rotational engaging grooves 3a are partially formed in the inner circumferential face of the middle shaft 3, and arciform stubs 7a partially formed on the outer circumferential face of the linking member 7 are engaged with the rotational engaging grooves 3a. The contact and engagement of these rotational engaging groove 3a and stubs 7a prevent the middle shaft 3 and the rear shaft 4 (the grip portion 1) from rotating excessively, and rotational deforming stress is thereby prevented from working on the grip portion 1 more than necessary. Rotation of the middle shaft 3 and the rear shaft 4 relative to each other by about 90 degrees in one direction causes the stubs 7a of the linking member 7 to come into contact with ends of the rotational engaging grooves 3a in the middle shaft 3 to restrict the relative rotation in this embodiment, but this rotational angle (range) can be set as appropriate.

Next will be described a variation of the way of providing a frictional resistance force against the relative rotation of the middle shaft 3 and the linking member 7 with reference to Figure 8. An internal step 3b is formed on the inner circumferential face of the middle shaft 3. On the other hand, an external step 7b is formed on the outer circumferential

face of the linking member 7. Between the internal step 3b and the external step 7b, there is crimped the ring 8 whose section consists of a circular soft member. Crimping of the ring 8 provides frictional resistance against the relative rotation of the middle shaft 3 and the linking member 7. Although typical materials for the ring 8 in the foregoing example and this example include rubber-like elastic materials such as silicone rubber, nitrile butadiene rubber, natural rubber, styrene rubber, styrene butadiene rubber, butadiene rubber, chloroprene rubber and urethane rubber, the material can as well be selected from such soft resin materials as polyethylene, polypropylene and polyethylene terephthalate.

The example shown in Figure 9 and Figure 10 is another variation of the way of providing a frictional resistance force against the relative rotation of the middle shaft 3 and the linking member 7. A plurality of ribs 3c are formed on the inner circumferential face of the middle shaft 3. On the other hand, engaging ribs 7c which can be engaged with or disengaged from and can override the ribs 3c are formed on the outer circumferential face of the linking member 7. The engagement of these ribs 3c and engaging ribs 7c maintains the rotational deformation of the grip portion 1 by a restoring force.

However, when the grip portion 1 is rotationally deformed, the grip portion 1 is also extended in the lengthwise direction, and its substantive hardness increases and at the same time a stress to restore it from the extension also occurs. This may give rise to a gap in the joint between the forward shaft 2 (the middle shaft 3) and the grip portion 1. In order to

prevent this gap, each shaft can be fixed to the grip portion by adhesion or thermal fusion. Instead, the grip portion 1 may be formed longer than the fitting portion of the shaft cylinder 1, and the grip portion 1 in a state of compression  
5 in the lengthwise direction may be fitted to the middle shaft 3.

In the example shown in Figure 11 and Figure 12, a forward shaft 14 and a rear shaft 15 are rotatably linked to each other. Thus, the linking member 7 in the foregoing example is not  
10 used with a view to reducing the production cost. A detailed description will follow. The rear end of the grip portion 1 is fixed to the middle part of the rear shaft 15, while the forward end of the grip portion 1 is fixed to the forward part of the forward shaft 14. When the forward shaft 14 and the  
15 rear shaft 15 are rotated relative to each other, a twist is produced to the grip portion 1. In this example, too, there is arranged means of providing a frictional resistance force against the relative rotation of the rear shaft 15 and the forward shaft 14. Thus, a plurality of ribs 14a and 15a, which  
20 can be contacted with each other, are radially formed at the rear end of the rear shaft 15 and the forward end of the forward shaft 14. Further, the rear shaft 15 and the forward shaft 14 are urging each other all the time to keep the ribs 14a and the ribs 15a in contact with each other. The urging force  
25 is achieved as the grip portion 1, which is fixed to each other, draws one shaft toward the other. Thus in this embodiment the rear shaft 15 is fixed to the forward shaft 14 in a state that the grip portion 1 is extended beyond its natural length.

Since a stress to contract the grip portion 1 arises as a result, there occurs an action to draw and urge the rear shaft 15 and the forward shaft 14 to each other. However, the  
5   aforementioned urging force may be brought to act by another means or member, such as a coil spring or some other springy member. In such a configuration as described, a relative rotation between the rear shaft 15 and the forward shaft 14 will make their respective ribs 14a and 15a override each other thereby to rationally deform the grip portion 1 and, at the  
10   time the overriding is completed, the deformed shape is maintained.

Reference numerals 14b and 15b denote T-shaped stubs which, like their counterparts in the foregoing examples, are inserted into, for engagement with, T-shaped grooves in the grip portion  
15   1 (for instance, the T-shaped grooves 2b, shown in Figure 4 and Figure 6).

Whereas the concave portion 1d consisting of a recessed arc is formed in the grip portion 1 in the foregoing embodiments to facilitate fitting of the concave portion 1d to the gripping  
20   fingers when rotational deformation has been achieved to an appropriate extent, the specific shape of the grip portion can be selected as appropriate. A shape is shown in Figure 13 through Figure 15 for instance. Though it is a stripe shape of a substantially hexagonal column extending in the  
25   longitudinal direction in a state that the grip portion 1 is not rotationally deformed (see Figure 14), it is deformed into a spiral stripe once it is rotationally deformed (see Figure



13). Thus, a convex portion 1e and a concave portion 1d are formed on and in the stripe-deformed grip portion 1.

Also, the shape shown in Figure 15 and Figure 16 is also desirous. The grip portion 1 maintains a substantially  
5 cylindrical shape in section when it is not rotationally deformed. Once it is rotationally deformed, it varies into a shape whose central portion is flat (flat portion 1f) (see Figure 15 and Figure 16).

Further, another example shown in Figure 17 can be used.  
10 The grip portion 1 has many grooves 1g which are formed in the longitudinal direction when it is not rotationally deformed. The grooves 1g are deformed in spiral rotation when it is subjected to rotational deformation.

While many different examples have been explained in the  
15 foregoing description, in any of these examples a shape of the grip portion matching the preference of, or more suitable for, the user who holds the grip portion can be easily obtained by appropriate and selective rotational deformation.

Next, various examples of variation of fixing means for  
20 fixing the grip portion to the shaft will be described with reference to Figure 18 through Figure 21. The shaft cylinder is composed of a rear shaft cylinder 17, a middle shaft cylinder 18 and a forward shaft cylinder 19. The rear shaft cylinder 17 and the middle shaft cylinder 18 are unrotatably coupled  
25 to be unable to come off in the lengthwise direction while pinching between them an engaging step portion 20d of a grip 20. Also, the middle shaft cylinder 18 and the forward shaft cylinder 19, though rotatable relative to each other around

the central axis of the shaft cylinder, are coupled to be unable to come off in the lengthwise direction.

Ahead of the forward shaft cylinder 19, there are formed a plurality of longitudinally extending stubs 19a whose section is substantially arciform partially, and they are inserted into respectively matching ones of holes 20a which are formed in a forward part of the inside of the grip 20 and have substantially the same shape in section. These stubs 19a and holes 20a, though formed in four positions radially in this example, may instead be in three or five positions even in only one position, but preferably they should be formed in about four positions. Tapered faces 19e are formed at the tips of the stubs 19a to facilitate their insertion into the holes 20a. Also an end piece 21 is fitted to the forward end of the forward shaft cylinder 19, and this end piece 21 is detachably fitted with a screw mechanism.

On the other hand, a plurality of stubs 17a which extend in the direction of the length of the shaft cylinder and whose section is either elliptic or substantially arciform in part are formed ahead of the rear shaft cylinder 17, and they are inserted into respectively matching ones of holes 20b which are formed in the rear end face 20f of the grip 20 and whose section has substantially the same shape as the stubs 17a. Also, a reduced-diameter part 18g is formed in the rear part of the middle shaft cylinder 18, and rear flat portions 18e are provided in two opposite positions on the reduced-diameter part 18g. On the arciform side of the reduced-diameter part 18g, there is provided a protruding part 18c which is greater

than the reduced-diameter part 18g in diameter. Further, an outer diameter part 18f of a greater diameter is formed in the linking part between the middle shaft cylinder 18 and the reduced-diameter part 18g, and an engaging step portion 18b is formed as a result of the formation of the outer diameter part 18f. In addition, in the forward part of the inside of the rear shaft cylinder 17, there are formed flat faces 17c matching the flat portions 18e formed on the middle shaft cylinder 18 and a larger diameter part 17d matching the protruding part 18c.

A reduced-diameter part is formed in the rear part of the inside of the grip 20, and an engaging step portion 20d is formed as a result of the formation of this reduced-diameter part.

These features of configuration cause the middle shaft cylinder 18 and the rear shaft cylinder 17 to be unrotatably coupled by the engagement of their respective flat portions 18e and flat portions 17c, and longitudinally releasable by the engagement of the larger-diameter protruding part 18c of the middle shaft cylinder 18 with the matching larger diameter part 17d of the rear shaft. At the same time, by pinching the engaging step portion 20d inside the grip 20 and the rear end face 20f between the engaging step portion 18b of the middle shaft cylinder 18 and the forward end face 17b of the rear shaft cylinder 17, the rear part of the grip 20 is also made unrotatable relative to the middle shaft cylinder 18 (and the rear shaft cylinder 17) and coupled to be unable to come off in the lengthwise direction.

Also, a reduced-diameter part 19f is formed on the rear external face of the forward shaft cylinder 19, and a plurality of arciform stubs 19b which extend in the lengthwise direction are formed all over around the reduced-diameter part 19f. On the other hand, grooves 18a whose section is arciform are formed all over the internal face of the middle shaft cylinder 18 and in the lengthwise direction. The number of the stubs 19b of the forward shaft cylinder 19 and that of the grooves 18a of the middle shaft cylinder 18 are equal, and the stubs 19b and the grooves 18a are engaged with each other. Reference numeral 19c denotes an engaging step portion which links the middle shaft cylinder 18 and the forward shaft cylinder 19.

In the configuration described above, when the forward shaft cylinder 19 and the middle shaft cylinder 18 are rotated relative to each other, rotation takes place while the stubs 19b override grooves 18a. Then, though the grip 20 deformed by the rotation tries to restore its form, the rotationally deformed shape of the grip is maintained because the engaging force between the stubs 19b and the grooves 18a is greater than that restoring force. Further, a rotation restricting part 19d is provided behind the stubs 19b of the forward shaft cylinder 19, and the rotation restricting part 19d can be placed into contact with a rotation restricting part provided behind the grooves 18a of the middle shaft cylinder 18. In other words, by restricting the rotational angle between the forward shaft cylinder 19 and the middle shaft cylinder 18, excessive rotation deformation of the grip 20 is regulated thereby to prevent damage and other troubles.

Besides, in the process of rotational deformation of the grip 20, too, the grip 20 tries to restore its form from the rotationally deformed state, but the engagement between the holes 20a of the grip 20 and the stubs 19a of the forward shaft cylinder 19 and the aforementioned coupling of the rear part of the grip 20 with the middle shaft cylinder 18 and the rear shaft cylinder 17 maintain the rotationally deformed shape.

Another variation will be described with reference to Figure 22 through Figure 24. A plurality of holes 20c substantially orthogonal to the direction of the length of the shaft cylinder are formed in a side face of a reduced-diameter part 20g covered by the rear shaft cylinder 17 behind the grip 20, while stubs 18d which is in a snap-fit engagement with the holes 20c are formed behind the middle shaft cylinder 18. In other words, the middle shaft cylinder 18 is unrotatably coupled to the rear shaft cylinder 17 in a state engagement with the holes 20c of the grip 20 such that the cylinders 17 and 18 are unreleasable in the lengthwise direction and unable to come off. Furthermore, the engaging step portion 18b of the middle shaft cylinder 18 and the forward end face 17b of the rear shaft cylinder 17 are held in a pinching way between the engaging step portion 20d formed in the rear part of the inside of the grip 20 and an engaging step portion 20h formed in the rear part of the outside of the grip 20. The configuration is the same as in the foregoing examples in respect of other elements, which will only be denoted by reference numerals in the drawings but whose detailed description will be dispensed with.

Still another example of variation will be described with reference to Figure 25. In the rear part of the inside of the grip 20, like in the forward part of the inside, a plurality of holes 20e extending substantially in parallel to the direction of the length of the shaft cylinder are formed, and the holes 20e are engaged with a plurality of stubs formed behind the middle shaft cylinder 18. The configuration is the same as in the foregoing examples in respect of other elements, whose detailed description will be dispensed with.

Though the plurality of the holes 20e of the grip 20 in this embodiment are blocked on the rear side, their rear ends may be open, namely they may be through holes, for the convenience of molding.

#### Industrial Applicability

The present invention, by virtue of its structure and its actions described so far, can solve the problems noted above and provide an excellent variable grip structure. Thus, since an elastic member and a shaft body to which the elastic member is fixed are designed to be relatively rotatable and suitable means for keeping their relative rotating actions is provided, adaptation is made possible by the relative rotation of those shaft body and elastic member to the hand size and preference of the user, which may vary individually from one user to the other. Further, there is an additional advantage of allowing an appropriate degree of hardness to be selected and maintained. Moreover, these can be achieved by a relatively simple component configuration.